Wisconsin Beach Program
Annual Report
Beach Season 2005

Wisconsin Department of Natural Resources

Nicole Richmond – Wisconsin Beach Program Coordinator
Toni Glymph – Wisconsin Beach Program Manager

I. Introduction

The Federal Beaches Environmental Assessment and Coastal Health (BEACH) Act was passed in October of 2000, requiring States that border coastal or Great Lakes waters to develop beach monitoring and public notification programs. Under the BEACH Act, the U.S.EPA provides grants to States that have beaches bordering these coastal waters for the purpose of developing and implementing the monitoring and public notification programs. This report describes the continued efforts by the Wisconsin Department of Natural Resources (DNR) and its partners to conduct a statewide beach-monitoring program for the 2005 beach season. This effort was directed at Great Lakes coastal waters, Lake Michigan and Lake Superior. These activities were conducted during Federal Fiscal Year 2005 (October 1, 2004 - September 30, 2005).

II. Program Overview

This project brought together a Workgroup of state-level environmental and public health officials, local health officials, and other interested parties to design a beach monitoring and notification program. Approximately 55 miles of public beach miles and a total of 192 coastal beaches were identified along the Lake Michigan and Superior (Appendices A & B). The definition of "beach" for the purpose of Wisconsin BEACH Act implementation is:

> *"A publicly owned shoreline or land area, not contained in a man-made structure, located on the shore of Lake Michigan or Lake Superior, that is used for swimming, recreational bathing or other water contact recreational activity."*

The coastal beaches were geo-located using GPS technologies and maps were created for each county identifying all beaches. Additional GPS data layers were added to include the location of all wastewater treatment outfalls along with their proximity to the beaches. Additional information was collected for each beach for evaluation: the potential for impacts from storm water runoff, bather and waterfowl loads, and the location of outfalls and farms. This information was used to rank and classify beaches as "high," "medium," or "low" priority.

A standard sampling protocol was developed and standard advisory signs were designed based on feedback from a beach user survey in 2002 and public meetings held around the state (Appendices C, F). The Beach Health Website formerly designed and used by the Southeast Taskforce for beaches in Milwaukee, Racine and Kenosha was expanded to include all public beaches monitored under the BEACH Act program. The website and data management is contracted through the United States Geological Survey (USGS).

Goals & Objectives

The purpose of this project in 2005 was to continue a consistent statewide beach water-monitoring program to reduce the risk of exposure of beach users to disease-causing microorganisms in water. Selected beaches along the Great Lakes were monitored in accordance with BEACH Act requirements with prompt notification to the public whenever bacterial levels exceed EPA's established standards (Appendix D).

Time Schedule

The activities described in this report took place during Federal Fiscal Year 2005 (October 1, 2004 - September 30, 2005). This period encompasses the 2005 beach season, which is defined for Wisconsin coastal beaches as Memorial Day Weekend through Labor Day Weekend. At some coastal beaches in Wisconsin, swimming may not begin until mid-June due to colder water temperatures. Where weather and swimming history indicate this to be the case, initial sampling associated with this program was reduced or delayed to occur when swimming occurs, but began no later than June 15 (Figure1). This report describes activities before, during, and after the beach season proper, i.e. preparation, implementation and evaluation of the beach season.

Figure 1. Sampling occurring in April in Lake Superior by UW-Oshkosh student. Initial sampling has been reduced in some counties in the Lake Superior area due to cold water temperatures early in the Beach season.

Cooperators Involved

BEACH Act Workgroup:

Keep Our Beaches Open
Kenosha County Health Department
Ozaukee County Health Department
Wisconsin State Lab of Hygiene
State Bureau of Parks
City of Racine Health Department
City of Madison Public Health Department
City of Milwaukee Health Department
Milwaukee Metropolitan Sewerage District
State Department of Health & Family Services
University of Wisconsin - Milwaukee Water Institute
Wisconsin Department of Natural Resources

Beach Program Participants:

Ashland County Health Department
Bayfield County Health Department
Brown County Health Department
City of Milwaukee Health Department
Door County Health Department
Douglas County Health Department
Iron County Health Department
Kenosha County Division of Health
Kewaunee County Health Department
Manitowoc County Health Department
North Shore Health Department
Ozaukee County Health Department
City of Racine Health Department
Sheboygan County Human Services
Shorewood/Whitefish Bay Health Department
South Milwaukee Health Department
UW Oshkosh Dept. of Biology and Microbiology

Budget

- In September 2001 the DNR was awarded a developmental grant for $58,694. The 2002 grant was also targeted for program development in the amount of $228,396. This resulted in a total of $287, 090 for program development.
- In June of 2003 the DNR was awarded the first implementation grant in the amount of $225,670. Funds totaling $55,000 remaining from the development grant were added to the new implementation grant, resulting in the availability of $280,670 for implementation of the beach program in summer 2003.
- In June of 2004 the DNR was awarded a grant in the amount of $226,570. The amount of the grant was insufficient to fully implement the program. DNR funds were used along with a small amount of carryover to help the program meet its budget.
- In May of 2005, the DNR was awarded a grant in the amount of $226,260. Once again, the amount of the grant was insufficient to fully implement the program. The following table shows the Health Department contracts for the summer of 2005:

Participant Contracts

Ashland, Bayfield, Iron Counties	$29,750
Brown County	$1,950
City of Milwaukee	$25,850
City of South Milwaukee	$3,800
Door County	$49,850
Douglas County	$6,600
Kenosha County	$8,800
Kewaunee County	$3,700
Manitowoc County	$10,800
Ozaukee County	$19,400
Racine County	$5,500
Sheboygan County	$14,900
Village of Northshore	$2,050
Village of Shorewood	$3,000

Work Completed in 2005

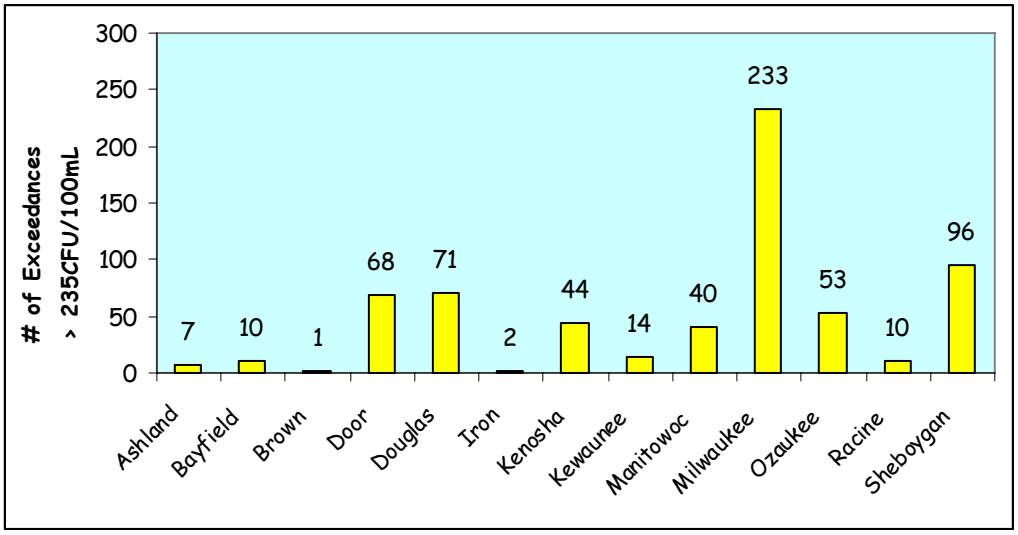
1. The Department met with the beach program participants and interested parties in March 2005 to evaluate the 2004 beach season. The meeting was aimed at getting feedback from those involved and to look at ways the program can be improved for the 2005 season.
2. As a result of feedback from the meeting, updates were made to the website for 2005. The changes included making data entry more 'user friendly' for the local health department officials; encouraging monthly data reviews and submissions to EPA.
3. In response to drawbacks in grant allocations to counties, local health officials had the opportunity to sample less often then their 'priority' ranking within the first couple weeks of the beach season, under the condition that they had previous data to support that less people visited the beach early in the season (i.e. less swimmers due to cooler water temperatures in Lake Superior). This resulted in more money later in the beach season, when more frequent sampling was needed.
4. The State contracted with 16 health departments for the 2005 beach season to conduct the routine monitoring of 124 beaches along Lake Superior and Lake Michigan.
5. A social survey was conducted on randomly selected beaches along Lake Superior and Lake Michigan. This survey was used to evaluate public awareness and notification methods of the Wisconsin Beach Program (Appendix E).

III. Project Highlights and Deliverables

- Changes were made to the website (www.wibeaches.us). The Frequently Asked Questions section was updated, and data entry was designed to be more efficient for the local health departments. An automatic e-mail service was continued in 2005 for the public to subscribe and get daily updates on beach conditions at beaches of their choosing.
- The UW-Extension worked cooperatively with the WDNR to continue the statewide toll-free telephone service to make updated beach advisories available to the public.
- The WDNR, Department of Health and Family Services, and the State Laboratory of Hygiene continued their statewide program of inland beach monitoring. Popular swimming beaches at 10 State Parks and Forests were monitored. The beaches were tested at least 4 times each week with results posted on the beach. The inland program was modeled after the Great Lakes program.
- A social survey was conducted late in the season, similar to the survey conducted in 2002. This survey showed that the public is interested in water quality and the signs posted at the beaches have been useful.

The 2005 beach season was the third year that a consistently implemented beach-monitoring program was conducted in the State of Wisconsin. A total of 112 beaches (124 monitoring sites) were sampled. There were 4441 monitoring samples collected during the 2005 beach season. Out of these samples, 649 of them exceeded the water quality limit of 235 CFU (or MPN in some cases)/100mL for *E.coli*. Inserted below is a graph depicting exceedances per county in 2005, and a comparative chart comparing exceedances over the past 3 beach seasons.

Graph 1. Number of Samples per County that Exceeded 235 CFU/100 mL for *E.coli* in 2005*



* This does not include pre-emptive advisories or advisories based on a geometric mean.

Chart 2. Number of Samples per County that Exceeded 235 CFU/100 mL for *E.coli*

County	2005	2004	2003
Ashland	7	16	7
Bayfield	10	5	5
Brown	1	1	0
Door	68	83	62
Douglas	71	26	29
Iron	2	1	1
Kenosha	44	62	35
Kewaunee	14	20	19
Manitowoc	40	115	187
Milwaukee	233	269	141
Ozaukee	53	105	75
Racine	10	26	39
Sheboygan	96	106	82
Totals	**649**	**835**	**682**

The number of overall exceedances in 2005 was lower than 2004 and 2003. This may be due to dry/drought conditions throughout the state in 2005. In spite of budget challenges, the 2005 program offered more options for making beach water quality information available to the public in a timely manner.

Success Stories and Concurrent Research Projects

Many people that care about coastal beach health ask the question, "We our monitoring the beaches, but what are we doing with the data? What's next? Where's the source of the problem?" The public's concerns are being heard and local health departments are responding. Below are some of the research projects being conducted in Wisconsin to help answer some of the questions.

Door County

Door County is one of Wisconsin's popular tourists destinations in summer. Recreational water is an important resource to the economy of this county. The BEACH Act grant was used to monitor 28 Great Lakes beaches in Door County in the summer of 2005. Monitoring money , however was not plentiful enough to allow for source identification of detected microbial contamination. Steps have progressed from last summer to try and answer the question, "where is the contamination coming from and is it safe to swim at the beach?"

The Door County Soil and Water Conservation Department (interested in source tracking issues and remediation of contamination sources) joined forces with UW-Oshkosh to tackle the issue. The following objectives for source tracking of microbial contamination in the county were established:

- Monitor *E. coli* concentrations at selected beaches in water with a depth of 12" and 48", in addition to the monitoring samples taken from water with a depth of 24". These data could be used to determine a density gradient for *E. coli* concentration and perhaps help to identify the direction from which contamination entered the beach area.
- Monitor *E. coli* concentrations at selected beaches at the depths indicated above, not only in the center of the beach (monitoring site), but also on the left and right sides of the beach and in front of any outfalls around the beach area. Again, these data could be used to help identify the direction from which the contamination moved and help determine if outfall runoff added significantly to the beach *E. coli* concentrations.
- Monitor *E. coli* concentrations at selected beaches after significant (0.5 inches or greater) rainfall; 1,2,3,4,8,12, and 24 hours after the rainfall. These data would help determine if storm water runoff contributed significantly to microbial contamination of beaches.
- Monitor avian waste concentrations on selected beaches in order to correlation avian waste (rather than bird numbers) with *E. coli* concentrations in beach water. Since birds (gulls, geese, ducks) often sit on beaches for portions of the day, a count of birds at any one time will not accurately reflect the total number of birds present each day. These data will help determine if waterfowl feces contribute significantly to microbial contamination of Door County beaches.
- Monitor pathogens (*Salmonella, Shigella, Campylobacter*) in selected beach water. No *Salmonella* or *Shigella* could be found, but *Campylobacter* was detected at most of the beaches investigated. Serotype *Campylobacter* isolates to try to determine source of the isolates.

- Beach sand and *Cladophora* accumulations on several selected beaches was washed and *E. coli* was enumerated. This was a preliminary study designed to determine if *E. coli* was able to survive and/or replicate in these substrates.
- Isolate *E. coli* from beach water, avian waste, human waste, sand, and *Cladophora* in Door County and conduct DNA fingerprinting and antibiotic sensitivity profiling of these isolates. These data would be used to further characterize the indicator organism used to monitor beach water quality and help to identify the source of contamination. In 2005 additional beaches were added to the source ID project.
- Monitor three inland lakes in Door County for microbial contamination in order to more fully protect public health.

Next, the Door County Soil and Water Conservation Department acquired funding to pay samplers and analysts to meet the objectives listed above. This brought Door County funding, as well as individual town funding to the project to help fund the research.

In addition, two municipalities, City of Sturgeon Bay and the Town of Ephraim, determined that they would like to study *E.coli* within storm water pipes. Both municipalities contributed financially to investigations into *E. coli* located within storm water conveyances during rainfall events. UW-Oshkosh researches enumerated *E.coli* as well as conducted DNA fingerprinting to try to determine source of the organism.

A private resort (Heritage Lake) utilized the laboratory services for *E.coli* testing of a swimming pond on the property.

A triathlon was held in July, 2005 at Murphy Park Beach, one of the monitored Door County Beaches. The organizers worked with the laboratory to monitor *E.coli* not only at the beach proper (start of swim) but also at the boat launch located nearby (end of swim). Additional samples were collected to best protect the participant's health. Organizers paid for the cost of the additional sampling.

Lastly, the Fish Creek Watershed Group and the Bayshore Property Owners (two groups of private citizens) collected water samples at private beaches and from outfalls located around these beaches. They funded the monitoring efforts by bringing in grant money or by utilizing Property Association dues, respectively. This helped to fund additional monitoring information and source identification efforts. The private citizen groups were able to bring samples to the Door County laboratory (no shipping involved) and obtain results in a timely fashion and for a reasonable fee.

The combined efforts between beach monitoring and microbial source tracking in Door County have resulted in another summer's worth of excellent data to be analyzed. In 2005, approximately 1000 *E.coli* isolates were collected from water and waste and the majority have been DNA fingerprinted and antibiotic sensitivity tested. This information has been added to the database from previous years and researchers are beginning to see patterns in isolates. In addition, a large amount of spatial and rain data has been collected for the studied beaches. In all cases *E.coli* concentrations were greater in water collected closer to shore and storm water runoff appears to have a negative impact on beach water quality for at least 8 hours after a significant

rainfall event. Approximately 10 scientific presentations and several published papers have resulted from these data. A full report of the findings will be presented to the Door County Board in January 2006.

Lake Superior Counties: Ashland, Bayfield, and Iron

Figure 2. Maslowski Beach, Iron County

Figure 3. Superior Falls, Washburn

Ashland, Bayfield and Iron Counties have 200 miles of Lake Superior shoreline with an extreme dichotomy of beach types (See Figures 2 and 3). The area contains high-valued tourist destinations. Among these counties, 27 beaches are monitored. The BEACH Act funding was inadequate for a comprehensive monitoring program, so other funding was sought. Several groups have been brought together to create a comprehensive monitoring and source-tracking program. The groups include: the local health departments, Northland College, University of WI-Oshkosh, and the Lake Superior Alliance. The following objectives have been aimed at by this collaboration:

- Investigate any high levels of *E.coli* with additional spatial sampling to assist in identifying the source of contamination. This includes investigation of tributaries, outfalls, and other inputs to Lake Superior in proximity to the beaches. This included vertical and horizontal sampling at several beach locations.
- Recovery of *E.coli* isolates from a variety of sources so that a database could be constructed to help determine the source of *E.coli* recovered from beach water samples. Over 2,000 *E.coli* isolates have been recovered from sources such as dogs, cattle, sheep, deer, gulls, geese, human sources, and from the beaches (beach water) under study.
- Investigate the implications of sampling at different water depths; 12, 24, 36, and 48 inches.
- Utilize genetic fingerprinting techniques (rep PCR), antibiotic resistance patterns, and spatial sampling to determine the source of beach water *E.coli* isolates.
- Conduct watershed investigations at select locations to determine impacts on beach water quality.
- Work with local health officials to mitigate any source of *E.coli* and beach contamination so beaches can remain open and public health is protected. Currently there are several proposals under consideration to mitigate *E.coli* at some of the locations with elevated levels.

In addition to the aforementioned objectives being met for 2005, many other successes have resulted from the BEACH program in Northern WI:

- A state of WI Certified Lab has been setup in an area that had no previous capability for beach testing. This lab also allows other local health departments and citizens to have samples collected and analyzed when they believe there is a problem with either a beach or another location in the area.
- Testing Lake Superior's public beaches have spurred counties to test their local inland beaches as well. Vilas and Oneida Counties in northern WI modeled their inland beach program after the Wisconsin Coastal Beach Program and sampled 16 beaches in the summer of 2005.
- Twenty-seven Lake Superior beaches now have baseline *E.coli* data and beach management decisions can be based on good scientific data.
- The use of genetic testing, antibiotic resistance patterns, and spatial sampling has identified several likely sources of *E.coli.*
- Having identified potential sources of contamination we can now start the process of source mitigation.
- There have been several public meetings at several locations in the Lake Superior region to bring all interested parties together to discuss water quality and beach 'health' issues.

The BEACH Act has brought a foundation to an economically disadvantaged area so that it can acquire high quality scientific data, protect public health at local beaches, help local officials acquire local data to respond to questions from citizens regarding the beach water quality, and help mitigate any issues that may pose a risk to human health. While there has been some growing pains as the program was initiated, overall, the program has been a tremendous success and is a great asset to Northern Wisconsin.

Racine County

Racine County's North Beach was re-certified as a "Blue Wave Beach" for 2005 from the *Clean Beaches Council*. The City of Racine Park's Department re-graded North Beach before the start of the beach season to provide better drainage and create a steeper berm crest. This management effort may have played a role in the reduction of water quality advisories (from 2004) in conjunction with their altered grooming practices.

The City of Racine received additional grants to fund microbial source tracking. One of the studies involving spatial distribution and host source determination of E. coli was funded by the S.C. Johnson Fund (year 2 of a 2-year study in conjunction with Dr. Sandra McLellan). This grant allowed Racine to determine what potential contamination sources influence surface water quality and how the sources were impacted by coastal conditions. This grant also helped determine the host source and potential for human sewage inputs from a variety of sources. Source tracking revealed those sources as having both human and non-human signatures, which allowed the program to fine-tune their efforts in 2005, to assist waste water treatment plants in identifying potential "hotspots" for microbial contamination.

Another grant received by the City of Racine was to look at potential human pathogens in gull feces funded by NIH (year 2 of a 2-year study in collaboration with Dr. Sandra McLellan and the

Milwaukee Health Department). This study screened gull fecal samples for potential human pathogens, both bacterial (*Salmonella, Plesiomonas, E.coli O157:H7, Campylobacter*) and parasitic (*Giardia* and *Cryptosporidium*) and designed a PCR test for their detection.

Lastly, a study was funded by the Wisconsin Coastal Management Program (in collaboration with Dr. John Skalbeck at UW-Platteville) to determine the relationship of E.coli to grain size distribution and the potential impacts of beach hydrological factors on surface water quality.

Milwaukee County

In addition to the projects mentioned above, Sandra McLellan, with the Great Lakes Water Institute (GLWI), is actively involved in source and transport mechanisms of *E.coli* at Lake Michigan beaches. One project, funded by the Wisconsin Sea Grant, focuses on two main items: 1) determining the source of elevated *E.coli* concentrations in surface water obvious contamination sources (stormwater or sewage overflows) are absent; 2) characterizing the *E.coli* patterns in the near shore waters of Door and Milwaukee counties.

Another project, the GLWI is working on is installing rain gardens and green roofs in urban areas to look at the benefits of using on-site storm retention systems to reduce the frequency of flooding events and its conveyance of pollutants to nearby surface waters.

Program Deficiencies

As the Wisconsin Beach Program continues to grow and change there are a few changes in the future that could improve our program to make it more successful:

- *Public concerns about source identification and risk mitigation.* Even after completing our third year of full implementation, the biggest public concern is still source identification and reduction. Although more communities are becoming more interested in the source of *E.coli* to their beaches, they are not implementing actions to control the source of contamination.
- *Complications regarding grant management.* The Wisconsin beach season begins a week prior to Memorial Day and continues through Labor Day in September. Although our season begins in May, the grant is not made available until June. In many cases monitoring and the purchase of supplies had to be delayed until the grant money was made available.
- *Insufficient Funding for Full Implementation.* For the second year in a row, the participating counties were asked to reduce monitoring at high priority beaches from 5 times per week to 4 times per week. The amount of funding made available is not enough for full implementation. Wisconsin received $226,260 and the amount needed for full implementation is approximately $300,000.

To Be Completed for the 2006 Beach Season

- Conduct public meetings as needed in spring of 2006, to receive input from local citizens regarding the Wisconsin Beach Program. These meetings re-evaluate the program, looking for ways to make the program even more successful for years to come.
- The hotline will be discontinued through UW-Extension in 2006. This issue has been discussed among the local health departments. Since the health departments already receive calls regarding water quality, to reduce costs, decals with local health department phone

numbers will be printed for the notification signs at the beaches. The phone numbers will also be available on our website.

- Draft state standards for use of *E. coli* as pathogen indicator or other indicator as requested by EPA guidance.

County	Priority
Ashland County	
Bayview Park	Medium
Big Bay State Park	Medium
Big Bay Town Park	Medium
Casper Road	Low
Kreher Park	Low
LaPoint Memorial	Low
Maslowski	Low
Bayfield County	
Bark Bay	Low
Bono Creek	Low
Broad Street	Low
Herbster	Low
Memorial - Bayfield	Low
Memorial Park - Washburn	Low
Port Wing East	Low
Port Wing West	Low
Sioux River North	Low
Sioux River South	Low
Siskiwit Bay	Low
Thompson West End Park	Low
Washburn Marina	Low
Wash Walking Trail/BAB	Low
Washington Ave	Low
Wikdal Memorial Boat Launch	Low
Highway 13 Wayside Beach	Not Monitored
Little Sand Bay	Not Monitored
River Loop Road Beach	Not Monitored
Brown County	
Bayshore	Low
Communiversity Park	Low
Longtail-North	Low
Longtail-South	Low
Bay Beach	Not Monitored
Joliet Park	Not Monitored
Riverside Drive	Not Monitored
Town Of Scott Park	Not Monitored
Van Lanen	Not Monitored
Volks Landing Boat Launch	Not Monitored
Douglas County	
Barker's Island Inner	Medium
Wisconsin Point #1	Medium
Allouez Bay #3	Low
Amnicon River	Low
Brule River #1	Low
Brule River #2	Low
Brule River #3	Low
Middle River	Low
Wisconsin Point #2	Low
Wisconsin Point #3	Low
Wisconsin Point #4	Low
Wisconsin Point #5	Low
Allouez Bay #1	Not Monitored
Allouez Bay #2	Not Monitored
Barker's Island Outer	Not Monitored
Connor's Point	Not Monitored

County	Priority
Door County	
Baileys Harbor	High
Egg Harbor	High
Ellison Bay Town Park	High
Ephraim	High
Fish Creek	High
Murphy Park	High
Newport Bay	High
Nicolet Bay	High
Otumba Park	High
Sister Bay	High
Sunset - Sturgeon Bay	High
Whitefish Dunes - Hwy WD	High
Whitefish Dunes - Inter Center	High
Anclam Park	Medium
Europe Bay Beach #1	Medium
Europe Bay Beach #2	Medium
Europe Bay Beach #3	Medium
Jackson Harbor Ridges	Medium
Lakeside Park	Medium
Percy Johnson	Medium
Portage Park	Medium
Sand Dune	Medium
Sandy Bay	Medium
School House	Medium
Sturgeon Bay Canal	Medium
Gislason Beach	Low
Haines Park	Low
Rock Island State Park	Low
Whitefish Bay Boat Launch	Low
Arrowhead Lane	Not Monitored
Bittersweet Lane	Not Monitored
Braunsdorf	Not Monitored
Chippewa Drive	Not Monitored
Clay Banks #1	Not Monitored
Clay Banks #2	Not Monitored
Cliff View Drive	Not Monitored
County Road TT	Not Monitored
Deer Path Lane	Not Monitored
Garrett Bay Boat Launch	Not Monitored
Goldenrod Lane	Not Monitored
Hemlock Lane	Not Monitored
Isle View Road	Not Monitored
Kickapoo Drive	Not Monitored
Lakeside Drive	Not Monitored
Lily Bay Boat Launch	Not Monitored
Pebble Road Beach	Not Monitored
Potawatomi State Park #1	Not Monitored
Potawatomi State Park #2	Not Monitored
Sand Bay Beach #1	Not Monitored
Sand Bay Beach #2	Not Monitored
Sand Cove Beach	Not Monitored
Sunset Beach Fish Creek	Not Monitored
White Pine Lane	Not Monitored
Winnebago Drive	Not Monitored

Iron County	
Oronto Bay #1	Low
Oronto Bay #2	Low
Oronto Bay #3	Low
Saxon Harbor East	Low
Saxon Harbor West	Low
Kenosha County	
Eichelman	Medium
Simmons Island	Medium
Pennoyer Park	Low
Southport Park	Low
Alford	Not Monitored
Lakeshore	Not Monitored
Marina (aka Melissa)	Not Monitored
Kewaunee County	
Crescent	Medium
City of Kewaunee	Low
9th Avenue Wayside	Not Monitored
Lighthouse Vista	Not Monitored
Red River Park	Not Monitored
Manitowoc County	
Hika Park	Medium
Memorial Drive North	Medium
Memorial Drive South	Medium
Neshota	Medium
Point Beach-Concession Stand	Medium
Point Beach-Lakeshore	Medium
Point Beach-Lighthouse	Medium
Red Arrow Park	Medium
YMCA	Medium
Fischer Park	Low
Lincoln High School	Not Monitored
Maritime Drive Boat Launch Beach	Not Monitored
Memorial Middle	Not Monitored
Silver Creek	Not Monitored
Two Creek Boat Launch	Not Monitored
University Beach	Not Monitored
Warm Water Beach	Not Monitored
Marinette County	
Michaelis Park	Not Monitored
Peshtigo Harbor Boat Launch	Not Monitored
Red Arrow Marinette #1	Not Monitored
Red Arrow Marinette #2	Not Monitored
Red Arrow Marinette #3	Not Monitored
Seagull Bar Wildlife Area	Not Monitored
Milwaukee*	
Bradford-North	High
Bradford-South	High
McKinley	High
South Shore	High
South Shore Rocky	High
Watercraft Beach	High
Atwater	Medium
Bayview Park	Medium

Milwaukee County	
Bender	Medium
Grant Park	Medium
Klode Park	Medium
Tietjen/Doctor's Park	Medium
Big Bay Park	Not Monitored
Sheriden Park	Not Monitored
*includes N. Milwaukee, City of Milwaukee, S. Milwaukee	
Oconto County	
Oconto City Park	Not Monitored
Ozaukee County	
Cedar Beach	High
County Road D Boat	High
Harrington State Park-North	High
Harrington State Park-South	High
Upper Lake Park-North	High
Upper Lake Park-South	High
Jay Road Beach	Not Monitored
Lion's Den Gorge Nature Preserve	Not Monitored
Pebble Beach Road	Not Monitored
Sandy Beach Road	Not Monitored
Silver Road Beach	Not Monitored
Virmond County Park	Not Monitored
Racine County	
North Beach #1	High
North Beach #2	High
North Beach #3	High
North Beach #4	High
Zoo Beach #1	High
Zoo Beach# 2	High
Zoo Beach #3	High
Michigan Boulevard	Not Monitored
Myers Park	Not Monitored
Parkway	Not Monitored
Shoop Park	Not Monitored
Wind Point Lighthouse	Not Monitored
Sheboygan County	
Blue Harbor Beach	High
Kohler Andrae Nature Center	High
Kohler Andrae North Beach	High
Kohler Andrae North Picnic	High
Kohler Andrae South Picnic	High
Deland Park	Medium
General King Park	Medium
Amsterdam Beach	Low
KK Road Beach	Low
Van Ess Road Beach	Low
3rd Street Beach	Not Monitored
Forest Road	Not Monitored
Lakeview Park	Not Monitored
Vollrath Park	Not Monitored
Whitcomb Ave	Not Monitored
Wilson Lima (aka Whites)	Not Monitored
Total Wisconsin Coastal Beaches	**192**

APPENDIX B. Beach Miles

County Code	County	# of Beaches	Total Beach Dist Miles	Total Beach Dist Ft	Total Beach Dist Mt
2	Ashland	7	3.02	15969	4869
4	Bayfield	19	5.12	27021	8238
5	Brown	9	3.80	20069	6120
15	Door	53	6.41	33820	10311
16	Douglas	16	5.77	30454	9283
26	Iron	5	1.44	7624	2325
30	Kenosha	7	2.81	14863	4532
31	Kewaunee	5	1.33	7025	2143
36	Manitowoc	17	7.65	40385	12308
38	Marinette	6	1.76	9268	2825
41	Milwaukee	13	4.81	25393	7742
43	Oconto	1	0.04	217	66
46	Ozaukee	11	3.44	18171	5537
52	Racine	7	2.03	10739	3274
60	Sheboygan	16	4.89	25823	7873
	State Total Beach Miles		54.32 Miles	272409 Feet	83024 Meters

APPENDIX C. Tiered Monitoring, Sampling and Analysis Plans

Tiered Monitoring Plan

The tiered monitoring plan describes the monitoring requirements for *High, Medium* and *Low* priority beaches. It also addresses when basic sampling should be conducted, when additional samples should be collected and where and how to collect samples.

High Priority Beaches

Basic Sampling	***Additional Sampling***	***Where to Sample***	***Depth to Sample***
• Begin sampling at least one week prior to the swimming season • Sample at least ***4 times*** per week during the swimming season	• After heavy rainfall (generally ¼ to ½ inch- depending on local conditions) • After a major pollution event where potential exists that indicator levels may be expected to exceed standard (sewage leak, spill) • Immediately following the exceedance of the water quality standards	*Depends on characteristics of the beach* • Middle of typical bathing area • For longer beaches, one sample for every 500m of beach	• Knee depth • Where 24-30 inch depth is first encountered, take sample 6-12 inches below surface of water • Other as you feel is necessary for your beach *(e.g., surface of water, waist depth, sediment)*

Medium Priority Beaches

Basic Sampling	***Additional Sampling***	***Where to Sample***	***Depth to Sample***
• Begin sampling at least one week prior to the swimming season • Sample at least ***2 times*** per week during the swimming season	• After heavy rainfall (generally ¼ to ½ inch- depending on local conditions) • After a major pollution event where potential exists that indicator levels may be expected to exceed standard (sewage leak, spill) • Immediately following the exceedance of the water quality standards	*Depends on characteristics of your beach* • Middle of typical bathing area • For longer beaches, one sample for every 500m of beach	• Knee depth • Where 24-30 inch depth is first encountered, take sample 6-12 inches below surface of water

Low Priority Beaches

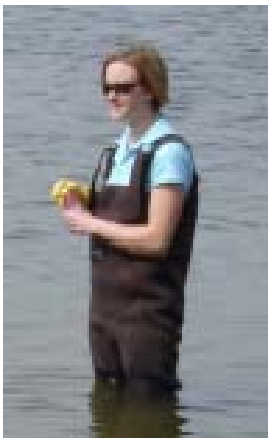
Basic Sampling	***Additional Sampling***	***Where to Sample***	***Depth to Sample***
• Begin sampling at least one week prior to the swimming season • Sampling frequency at low priority beaches should be determined by state and local authorities, taking into account resource constraints and evaluation of risk factors at individual beaches.	• After a major pollution event where potential exists that indicator levels may be expected to exceed standard (sewage leak, spill) • Immediately following the exceedance of the water quality standards	*Depends on characteristics of your beach* • Middle of typical bathing area	• Knee depth • Where 24-30 inch depth is first encountered, take sample 6-12 inches below surface of water.

Sampling Protocol

To assure consistency in collecting samples for analysis, the following procedures will be used:

1) Specific sites will be designated for collecting samples during the bathing season. Samples will be collected exclusively at these sites for the duration of the sampling period.
2) Sample bottles will be prepared and provided by the laboratories charged with conducting bacteria analyses.

General Rules of Sampling



- Take extreme care to avoid contaminating the sample and sample container.
- Do not remove bottle covering and closure until just prior to obtaining each sample.
- Do not touch the inside of the sample container.
- Do not rinse the sample container.
- Do not put caps on the ground while sampling.
- Do not transport the samples with other environmental samples.
- Adhering to sample preservation and holding time limits is critical to the production of valid data.
- Samples should be labeled, iced or refrigerated at 1 - 4 degrees C immediately after collection and during transit to the lab.
- Care should be taken to ensure that sample bottles are not totally immersed in water during transit or storage.
- Samples should arrive in the lab no later than 24 hours after collection. Whenever possible samples should arrive at the lab on the day of collection, preferably before 2 p.m.
- The sampler will complete the laboratory data form noting time, date, and location of sample collection, current weather conditions (including wind direction and velocity), water temperature, clarity, wave height and any abnormal water conditions.

Sampling Method

(1) Carefully move to the first sampling location. Water should be approximately knee deep. While wading slowly in the water, try to avoid kicking up bottom sediment at the sampling site.
(2) Open a sampling bottle and grasp it at the base with one hand and plunge the bottle mouth downward into the water to avoid introducing surface scum.
(3) The sampling depth should approximately 6 to 12 inches below the surface of the water.
(4) Position the mouth of the bottle into the current away from your hand. If the water body is static, an artificial current can be created by moving the bottle horizontally with the direction of the bottle pointed away from you.
(5) Tip the bottle slightly upward to allow air to exit and the bottle to fill.
(6) Make sure the bottle is completely filled before removing it from the water.
(7) Remove the bottle from the water body and pour out a small portion to allow an air space of 2 cm for proper mixing of the sample before analyses.
(8) Tightly close the cap and label the bottle.
(9) Store sample in a cooler filled with ice or suitable cold packs immediately.

Analytical Methods
All sample analyses shall be conducted by State certified labs using one of the following EPA approved methods:

Most probable number (MPN) tests for E. coli:
- LTB EC-MUG (Standard Methods 9221B.1/9221F
- ONPG-MUG (Standard Methods 9223B, AOAC 991.15, Colilert, Colilert-18, and Autoanalysis Colilert)

Membrane filter tests for E. coli:
- MEndo, LES-Endo, or mFC followed by transfer to NA-MUG media (Standard Methods 9222B/9222G or 9222D/9222G)
- MI Agar, M-ColiBlue24 Broth

APPENDIX D. Public Notification and Risk Communication Measures

A comprehensive communication plan was developed for the 2003 beach season by the Workgroup in 2002. The following methods have been implemented.

Beach Signs
EPA recommends the following criteria for *E. coli*:

- **235** cfu/100mL as a single sample maximum
- **126** cfu/100mL as a geometric mean of at least 5 samples collected over a 30-day period.

Posting Beach Advisories

High Priority Beaches
High priority beaches shall to post advisory signs (See Figure D1) under the following conditions:

- whenever the sample results for *E. coli, exceeds* **235** cfu/100mL as a single sample maximum
- and/or whenever the sample results for *E. coli, exceeds* **126** cfu/100mL as a geometric mean of at least 5 samples collected over a 30-day period.

Medium Priority Beaches
Medium Priority beaches shall post beach advisory signs whenever the level of *E. coli* in the beach water sample exceeds 235 cfu/100 mL.
Figure D1. Yellow "Caution" Advisory Sign

Figure D1. Yellow "Caution Advisory Sign

Low Priority Beaches
Monitoring at low priority beaches and the posting of signs will be determined on a case-by-case basis. Low priority beaches that are required to monitor weekly are shall post advisory signs whenever the level of *E. coli* in the beach water sample exceeds 235 cfu/100 mL.

Removing Advisory Signs
Beach advisory signs may be removed when the sample results of two consecutive days of sampling are below the established criteria.

Beach Closures
All beaches shall be closed under the following conditions:

- Whenever a human health hazard exists as determined by the local health department (i.e. reported illnesses).
- After a major pollution event where potential exists that indicator levels may be expected to exceed standard (sewage leak, spill)

Figure D2. Red "Closure" Sign

- After a significant rainfall event that is determined to impact a beach area.

All beaches shall post closure signs (Figure D2) whenever the level of *E. coli* in the beach water sample exceeds 1000 cfu/100mL.

Re-opening Beaches
Beach closure signs may be removed when the sample results of two consecutive days of sampling are below the established standard.

Beach Open Signs
Signs indicating that beach water quality is good will remain posted at beaches as long as none of the conditions for posting advisory or closure signs exist (Figures D3 & D4)

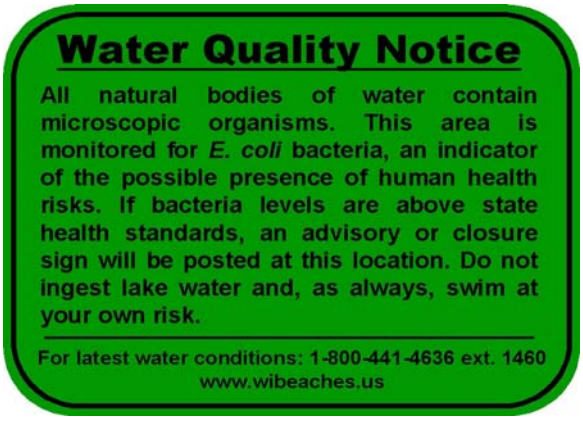


Figure D3. Green Informational Water Quality Sign

Figure D4. Blue "Good" Water Quality Sign

Figure D5. Sign Interpretation in Spanish & Hmong

Brochures
An informational brochure was developed by the workgroup and published by the UW-Extension. This brochure was developed for both Great Lakes and inland beaches. The brochure informs the public of why the waters are being tested, and what they can do as citizens to help keep the beaches clean.

Websites
The primary website (www.wibeaches.us) for Wisconsin Great Lakes beaches is administered by the US Geological Survey. The WDNR website (http://dnr.wi.gov/org/water/wm/wqs/beaches/) features a page about beach water quality, public health and the BEACH Act. Included in this website are up-to-date maps of where the public beaches are located in Wisconsin.

Phone Hotline
The DNR and the UW-Extension set up a Beach Health Hotline through the InfoSource Hotline in the summers of 2004 and 2005. The Beach Health Hotline phone number (1.800.441.4636

ext.1460) was placed on the beach notification signs and the website, and was also released in several newspaper articles throughout the state.

APPENDIX E. Results of 2005 Summer Social Survey

Scope of Project

For part of the review of Wisconsin's BEACH Act Implementation Program, social surveys were conducted on randomly selected beaches on Lake Michigan and Lake Superior. In August 2005, a survey of visitor's at 23 public beaches along Lake Michigan and Lake Superior was administered to a total of 112 individuals.

The purpose of the social survey was to see how many people know about the BEACH program and how many beach goers are concerned about water quality issues. The survey was based on a similar survey conducted in the summer of 2002 to track changes in beach visitor's knowledge, attitudes and behaviors. These social data will help guide local and statewide changes in the BEACH Act program for 2006 and beyond.

Results of Survey

A short, simple survey was developed to determine how many people have heard about the BEACH Act Program and the concerns of the public regarding water quality. Respondents were sampled at random from the beach's population. The interviewer introduced themselves to the respondent, explaining the purpose of the questionnaire. The survey was conducted if the respondent agreed to answer a few questions. The survey took approximately two minutes to conduct with each individual.

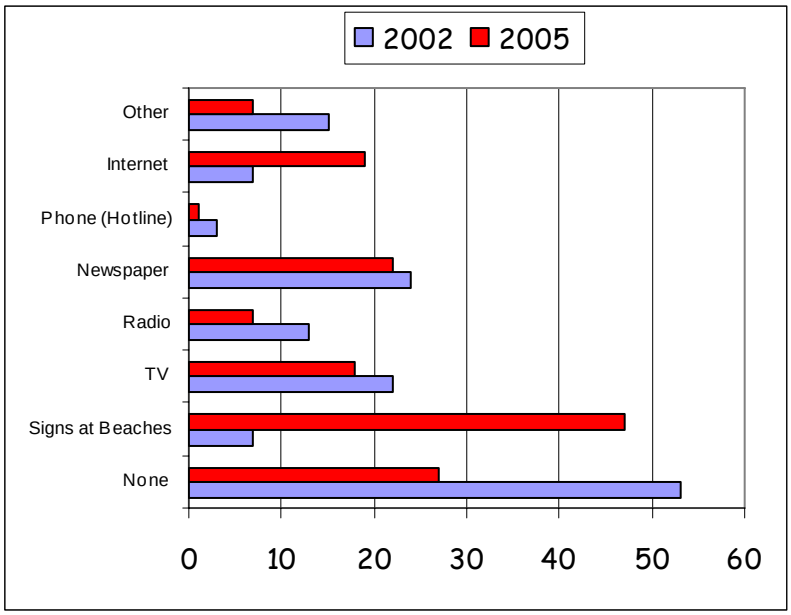
The survey was conducted to see if there were significant changes in attitudes and concerns from the social survey conducted in 2002. The one drawback for the survey was, due to time constraints, only 112 beach visitors were interviewed. Larger samples would benefit each county, so they could re-evaluate their beach monitoring and notification programs. Although the number of survey respondents was limited, the survey still shed some light on some issues that the state and counties may want to respond to.

Tourism is an important part of the economy for many of the counties along the Great Lakes in Wisconsin. Respondents were asked if they lived within 20 miles of the beach (anything outside of 20 miles, we considered a tourist). Sixty-one percent of respondents were considered tourists in our survey.

One of our goals for the survey was to find out the level of concern the public had for water quality issues at the beach. Approximately half (53%) of the people surveyed said they had concerns about water quality when they visited the beach. Three-fourths (77%) of the respondents said they planned to recreate in the water the day they were interviewed. Another question we asked participants was "Have you ever become ill from swimming at the beach?" Twelve out of 112 people said yes they had become ill from swimming. No follow-up questions were asked regarding their 'illness.'

The primary goal of the summer survey was to re-visit our current notification methods, to see how effective our program has been on educating the public on beach water quality issues. The most effective way to communicate with the public seems to be posting the signs at the beaches. Standard state-wide beach advisory and closure signs were improved in 2004 (see Appendix D). Fifty-eight percent of respondents said they saw the posted signs that day at the beach. Seventy-five percent of the people that saw the sign actually took time to read it. Since the goal of the sign is to educate the public about testing the waters and alerting them when health risks are higher, a question asked was "Have you swam at the beach despite the health risk warning signs?" Nineteen out of 112 people said yes they had swam despite the warning signs. Thirty-four people said "no." Many people replied that they "did not know", since they had not read the sign.

Graph 2. Survey Results: Where Do People Get Their Information on Beach Water Quality? 2002 vs. 2005



The 2005 social survey provided the following feedback:

- Better methods should be developed to notify the citizens and tourists of Wisconsin about our monitoring efforts for the WI Beach Program. Many people had not heard about the Beach Act or the Wisconsin Beach Program. When asked where people get their water quality information; in 2002, the top two sources were: "nowhere" and "the newspaper" in 2005, the top two sources were "signs" and "nowhere."
- Our website, used as a primary notification tool, was used twice as much in 2005 than 2004.
- People in 2005 requested other methods of notification than in 2002. In 2005, the top three choices for people to find information about water quality were: internet, TV and newspaper. In 2002, the top three choices were: internet, phone and other.
- Since the hotline through UW-Extension has been cut for next year, we have decided not to have a separate hotline for beach goers. Instead, we will be posting the local health department's phone numbers on the sign for visitors to call for more information.

The 2005 social survey provided us with data to increase awareness about coastal beach health through our notification methods. The Wisconsin Beach Program was successful for it's third monitoring season. As the Wisconsin Beach Program continues, we hope to learn from our collected scientific data and grow towards a successful future of protecting Great Lakes water quality and public health.